DURA PULSE

Dynamic Braking User Manual

GS-DB_UMW

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~ WARNINGS ~

Warning: Always read this manual thoroughly before using the DURApulse Dynamic Brake Unit with the DURApulse AC Motor Drive.

Warning: AC input power must be disconnected before performing any maintenance. Do not connect or disconnect wires or connectors while power is applied to the circuit. Maintenance must only be performed by a qualified technician.

Warning: There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. To avoid damage to these components, do not touch these components or the circuit boards with metal objects or your bare hands.

Warning: A charge may still remain in the AC drive's DC-link capacitor(s) with hazardous voltages even if the power has been turned off to the AC drive. To avoid personal injury, do not remove the cover of the DURApulse Dynamic Brake Unit or the AC drive until the power has been disconnected from the AC drive and all "DISCHARGE" indicators on the devices are off. Please note that there are live components exposed within the brake unit and the AC drive. Do not touch these live parts.

Warning: Ground the DURApulse Dynamic Brake Unit using the ground terminal. The grounding method must comply with the laws of the country where the brake unit is to be installed. Refer to the "Basic Braking Wiring Diagram" shown in "Chapter 3: Component Configuration and Wiring."

Warning: The mounting enclosure of the DURApulse Dynamic Brake Unit must comply with EN50178. Live parts shall be arranged in enclosures or located behind barriers that meet at least the requirements of the Protective Type IP20. The top surface of the enclosures or barrier that is easily accessible shall meet at least the requirements of the Protective Type IP40. Users must provide this environment for the brake unit and braking resistor.

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DURAPULSE DYNAMIC BRAKING USER MANUAL REVISION HISTORY

Please include the Manual Number and the Manual Issue, both shown below, when communicating with Technical Support regarding this publication.

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ISSUE: ***SECOND EDITION, REVISION D***

ISSUE DATE: ***06/10/2022***

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ISSUE	***DATE***	***DESCRIPTION OF CHANGES***
First Edition	11/17/2003	Original
1st Ed. Rev.A	03/2004	Minor changes
1st Ed. Rev.B	07/2009	GS-2050-BR-ENC specifications
Second Edition	09/28/2017	User Manual name change (previous name: GS3-DB-M) Added GS4 series AC Drives Added (5) GS-xDB series Dynamic Braking Units; where x = 1,3,5,6,7 Added (19) GS-BR-xxxWxxx series Dynamic Braking Resistors Added Chapters 2 and 3 Modifications to braking resistor dimension drawings Ch2
2nd Ed. Rev.A	10/26/2017	Bar code Ch2: Dimensions for resistors GS-20P5-BR & GS-21P0-BR
2nd Ed. Rev.B	05/17/2019	User Manual name change (previous name: GS-DB_UMP) Ch3: Thermal overload relay recommendation and wiring diagram
2nd Ed. Rev.C	06/14/2019	Ch3: Basic Braking Wiring Diagram
2nd Ed., Rev. D	06/10/2022	Ch1 and Ch2: Added new braking resistors for GS20 drives

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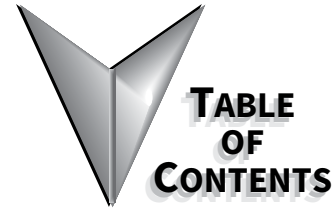

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BRAKING OVERVIEW AND COMPONENT SPECIFICATIONS

CHAPTER 1

TABLE OF CONTENTS

Manual Overview

Overview of this Publication

The *DURAPULSE* Dynamic Braking User Manual describes the installation, wiring, configuration, and operation of the dynamic braking unit and braking resistors as used with GS3 and GS4 series *DURAPULSE* AC Drives.

The content of this user manual may be revised without prior notice. Please visit the Automationdirect.com website to download the most recent version. (www.automationdirect.com)

Who Should Read This Manual

This manual contains important information for those who will install, maintain, and/or operate any *DURAPULSE* GS3 or GS4 series AC Drive that makes use of the dynamic braking in their application.

Supplemental Publications

The *DURAPULSE* AC Drive User Manuals (GS3-M & GS4-M) are available from AutomationDirect and should be used along with this manual to properly install and operate both the *DURAPULSE* AC drive and the *DURAPULSE* dynamic braking unit.

The National Electrical Manufacturers Association (NEMA) publishes many different documents that discuss standards for industrial control equipment. Global Engineering Documents handles the sale of NEMA documents. For more information, you can contact Global Engineering Documents at:

15 Inverness Way East
Englewood, CO 80112-5776
1-800-854-7179 (within the U.S.)
303-397-7956 (international)
www.global.ihs.com

NEMA documents that might assist with your AC drive systems are:

- Application Guide for AC Adjustable Speed Drive Systems
- Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems

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When you see the "notepad" icon in the left-hand margin, the paragraph to its immediate right will be a special note.

When you see the "exclamation mark" icon in the left-hand margin, the paragraph to its immediate right will be a warning. This information could prevent injury, loss of property, or even death (in extreme cases).

Introduction

Dynamic Braking

All *DURAPULSE* GS3 and GS4 series AC drives are capable of dynamic braking to enable an AC motor with a high-inertia load to decelerate more rapidly than could be otherwise achieved, and to absorb the energy generated when a three-phase induction motor decelerates.

Applications with high-inertia type loads tend to cause the motor to regenerate energy back into the AC drive. This regeneration causes the AC drive's internal DC bus voltage to rise, which can cause an over voltage fault. With dynamic braking, the energy generated by the overhauling motor is dissipated through dedicated braking resistors as heat.

As shown in the selection tables in this chapter, lower-capacity drives can connect directly to the optional external braking resistors, but higher-capacity drives also require optional dynamic braking units installed between the drives and resistors.

Dynamic Braking Units

DURAPULSE dynamic braking units are used with larger *DURAPULSE* AC Drives to continuously monitor the drive's DC bus voltage. When bus voltage exceeds a predetermined level (depending on the supply voltage) the dynamic braking unit dissipates the excess energy into external resistors in the form of heat. *DURAPULSE* dynamic braking units must be used along with GS series braking resistors to provide optimum braking performance.

DURAPULSE dynamic braking units are available for both 230V or 460V *DURAPULSE* AC Drives. MASTER/SLAVE configurations allow the use of multiple *DURAPULSE* dynamic braking units in order to accommodate the power ratings of larger *DURAPULSE* AC Drives and motors.

DURAPULSE dynamic braking units (GS-1DBU, GS-2DBU, GS-3DBU and GS-4DBU) are approved by Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL).

Unpacking

After receiving the *DURAPULSE* dynamic braking unit, please check for the following:

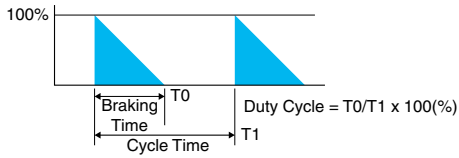
- Make sure that the part number indicated on the package corresponds with the part number of your order.
- Make sure that the package includes the *DURAPULSE* dynamic braking unit and the *DURAPULSE* dynamic braking unit User Manual.
- Inspect the contents to insure they were not damaged during shipment.

Braking Duty Cycle

Application of a *DURAPULSE* dynamic braking unit should take into account how often the motor will stop or decelerate during normal operation. The Duty Cycle is the percentage of time the brake is actually used during deceleration in comparison to the time elapsed between each start or acceleration of the motor. This Duty Cycle percentage is necessary to allow the dynamic braking unit and braking resistor(s) sufficient time to dissipate the heat created during dynamic braking. If the Duty Cycle is exceeded, the braking resistor will not cool sufficiently, causing resistance to increase as the temperature rises with the loss of effective braking torque.

Example: If in a given application it is determined that it will take 10 seconds for the motor to decelerate to a stop using dynamic braking, then the motor can only be cycled on and off continuously every 1.6 minutes (100 seconds).

- 10 / 100 x 100 = 10% Duty Cycle



The maximum braking On-Time for the maximum 10% Duty Cycle is 10 seconds.

Overload Relay

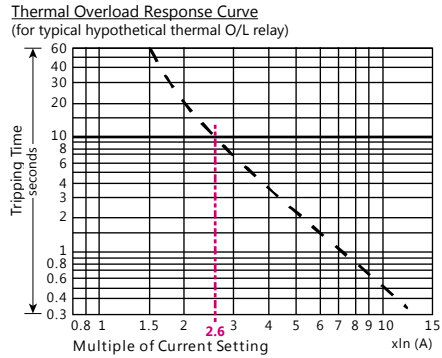
Overload Relay Purpose

For safety purposes, install an external overload relay between the dynamic brake unit and the braking resistor. The thermal overload relay protects the braking resistor from damage due to frequent braking, or due to the braking unit operating excessively due to unusually high input voltage.

Overload Relay Selection Procedure and Example

(For a GS4-4150 drive)

1) Select a thermal overload relay based on its overload capability.



Standard braking capacity for GS3 and GS4 AC drives is 10% duty cycle (tripping time = 10s). Determine the 10s Overload Capacity (Multiple of Current Setting) for your selected overload relay.

The intersection of the Trip Time (10s) and the Multiple of Current Setting is 2.6 (or 260%) for this example response curve.

The property of each thermal relay may vary by manufacturer, so please read the specifications carefully.

2) Use the appropriate AC Drive Braking Component Selection table in this chapter to find the Max Total Brake Current for the motor, drive, and braking components (126A for this example).

GS*4* AC Drive Braking Component Selection

Drive Voltage	Motor Power		125% Braking Torque @ 10% Duty Cycle					Brake Torque (kg-m)	Total Brake Current (A)	Max Braking Torque			Wiring Diag.
				Braking Unit		Braking Resistor							
	(HP)	(kW)	AC Drive Model # GS4-	Quantity	Part # GS-	Quantity	Part # GS-BR-			Min Resistor Value (Ω)	Max Total Brake Current (A)	Peak Power (kW)	
460V	150	110	4150	1	5DBU	10	1K2W015	74.5	126	6.0	126	95.8	L

3) Divide the Max Total Braking Current by the Overload Capacity (126A / 2.6 = 48.46A), and select a thermal O/L relay which has the same or higher rated current. In this case, select a 50A relay.

For wiring information, refer to "Overload Relay" in Chapter 3, page 3-2.

Dynamic Braking Component Selection for *DURApulse* AC Drives

The following table provides the selection information for the *DURApulse* dynamic braking units designed for use with GS3 and GS4 series AC drives.

Braking Component Selection for GS3 DURApulse Drives

NOTE: For breaking resistor compatibility with other Automation Direct VFDs (GS10, GS20, ACN) consult the user manual Appendix A for each VFD. For WEG CFW drives, consult the Automation direct technical pages.

GS3 AC Drive Braking Component Selection

Drive Voltage	Motor Power		125% Braking Torque @ 10% Duty cycle***						Max Braking Torque			Wiring Diagram **
			AC Drive Model #	Braking Unit		Braking Resistor		Brake Torque	Total Brake Current	Min Resistor Value	Max Total Brake Current	Peak Power	
	(HP)	(kW)	GS3-	Quantity	Part # GS-	Quantity	Part # GS-	(kg·m)	(A)	(Ω)	(A)	(W)	
230V	1	0.7	21P0			1	21P0-BR	0.5	1.9	82	4.6	1.8	
	2	1.5	22P0			1	22P0-BR	1.0	3.8	82	4.6	1.8	
	3	2.2	23P0			1	23P0-BR	1.5	5.4	82	4.6	1.8	
	5	3.7	25P0	0	n/a	1	25P0-BR	2.5	9.5	33	11.5	4.4	A
	7.5	5.5	27P5			1	27P5-BR	3.7	12.7	30	12.7	4.8	
	10	7.5	2010			1	2010-BR-ENC	5.1	19.0	20	19.0	7.2	
	15	11	2015			1	2015-BR-ENC	7.5	27.9	13.6	27.9	10.6	
	20	15	2020	1	2DBU	1	2020-BR-ENC	10.2	38.0*	10*	38.0*	14.4*	
	25	18	2025	1	2DBU	1	2025-BR-ENC	12.2	47.5*	8*	47.5*	18.1*	D
	30	22	2030	1	2DBU	1	2030-BR-ENC	14.9	55.9*	6.8*	55.9*	21.2*	
	40	30	2040	2	2DBU	2	2040-BR-ENC	20.3	38.0*	10*	38.0*	14.5*	F
	50	37	2050	2	2DBU	2	2050-BR-ENC	25.1	47.5*	8*	47.5*	18.1*	
460V	1	0.7	41P0			1	41P0-BR	0.5	1.0	160	4.8	3.6	
	2	1.5	42P0			1	42P0-BR	1.0	1.9	160	4.8	3.6	
	3	2.2	43P0			1	43P0-BR	1.5	3.0	160	4.8	3.6	
	5	3.7	45P0	0	n/a	1	45P0-BR	2.5	5.1	130	5.8	4.4	A
	7.5	5.5	47P5			1	47P5-BR	3.7	7.6	91	8.4	6.3	
	10	7.5	4010			1	4010-BR	5.1	10.1	62	12.3	9.3	
	15	11	4015			1	4015-BR-ENC	7.5	15.2	39	19.5	14.8	
	20	15	4020	1	4DBU	1	4020-BR-ENC	10.2	19.0*	40*	19.0*	14.4*	
	25	18	4025	1	4DBU	1	4025-BR-ENC	12.2	23.8*	32*	23.8*	18.1*	
	30	22	4030	1	4DBU	1	4030-BR-ENC	14.9	27.9*	27.2*	27.9*	21.2*	
	40	30	4040	1	4DBU	1	4040-BR-ENC	20.3	38.0*	20*	38.0*	28.9*	D
	50	40	4050	1	4DBU	1	4050-BR-ENC	25.1	47.5*	16*	47.5*	36.1*	
	60	45	4060	1	4DBU	1	4060-BR-ENC	30.5	55.9*	13.6*	55.9*	42.5*	
	75	55	4075	2	4DBU	2	4075-BR-ENC	37.2	38.0*	20*	38.0*	28.9*	F
	100	75	4100	2	4DBU	2	4100-BR-ENC	50.8	55.9*	13.6*	55.9*	42.5*	

** These values are per individual DBU, as seen between DBU terminals B1 and B2.*

*** Wiring diagrams are shown in Chapter 3: Component Configuration and Wiring.*

**** 10% Duty Cycle with maximum ON (braking) time of 10 seconds.*

Braking Component Selection for GS4 DURApulse Drives

GS4 AC Drive Braking Component Selection

Drive Voltage	Motor Power		125% Braking Torque @ 10% Duty Cycle***							Max Braking Torque			Wiring Diagram **
			AC Drive Model #	Braking Unit		Braking Resistor		Brake Torque	Total Brake Current	Min Resistor Value	Max Total Brake Current	Peak Power	
	(HP)	(kW)	GS4-	Quantity	Part # GS-	Quantity	Part # GS-BR-	(kg·m)	(A)	(Ω)	(A)	(kW)	
230V	1	0.7	21P0	0	n/a	1	080W200	0.5	1.9	63.3	6	2.3	A
	2	1.5	22P0			1	200W091	1.0	4.2	47.5	8	3.0	
	3	2.2	23P0			1	300W070	1.5	5.4	38.0	10	3.8	
	5	3.7	25P0			1	400W040	2.5	9.5	19.0	20	7.6	
	7.5	5.5	27P5			1	1K0W020	3.7	19	14.6	26	9.9	
	10	7.5	2010			1	1K0W020	5.1	19	14.6	26	9.9	
	15	11	2015			1	1K5W013	7.5	29	12.6	28	10.6	
	20	15	2020			2	1K0W4P3	10.2	44	8.3	46	17.5	B
	25	18	2025			2	1K0W4P3	12.2	44	8.3	46	17.5	
	30	22	2030			2	1K5W3P3	14.9	58	5.8	66	25.1	
	40	30	2040	2	1DBU	4	1K0W5P1	20.3	75*	4.8*	80*	30.4*	G
	50	37	2050	2	2DBU	4	1K2W3P9	25.1	97*	3.2*	120*	45.6*	
	60	45	2060	2	2DBU	4	1K5W3P3	30.5	118*	3.2*	120*	45.6*	
	75	55	2075	3	2DBU	6	1K2W3P9	37.2	145*	2.1*	180*	68.4*	J
	100	75	2100	4	2DBU	8	1K2W3P9	50.8	190*	1.6*	240*	91.2*	K
460V	1	0.7	41P0	0	n/a	1	080W750	0.5	1	190	4	3.0	A
	2	1.5	42P0			1	200W360	1	2.1	126.7	6	4.6	
	3	2.2	43P0			1	300W250	1.5	3	108.6	7	5.3	
	5	3.7	45P0			1	400W150	2.5	5.1	84.4	9	6.8	
	7.5	5.5	47P5			1	1K0W075	3.7	10.2	54.3	14	10.6	
	10	7.5	4010			1	1K0W075	5.1	10.2	47.5	16	12.2	
	15	11	4015			1	1K5W043	7.5	17.6	42.2	18	13.7	
	20	15	4020			2	1K0W016	10.2	24	26.2	29	22.0	B
	25	18	4025			2	1K0W016	12.2	24	23.0	33	25.1	
	30	22	4030			2	1K5W013	14.9	29	23.0	33	25.1	
	40	30	4040			4	1K0W016	20.3	47.5	14.1	54	41.0	C
	50	40	4050	1	4DBU	4	1K2W015	25.1	50*	12.7*	60*	45.6*	E
	60	45	4060	1	4DBU	4	1K5W013	30.5	59*	12.7*	60*	45.6*	
	75	55	4075	2	3DBU	8	1K0W5P1	37.2	76*	9.5*	80*	60.8*	H
	100	75	4100	2	4DBU	8	1K2W015	50.8	100*	6.3*	120*	91.2*	I
	125	90	4125	2	4DBU	8	1K5W013	60.9	117*	6.3*	120*	91.2*	
	150	110	4150	1	5DBU	10	1K2W015	74.5	126*	6.0*	126*	95.8*	L
	175	132	4175	1	6DBU	12	1K5W012	89.4	190*	4.0*	190*	144.4*	M
	200	160	4200	1	6DBU	12	1K5W012	108.3	190*	4.0*	190*	144.4*	
	250	185	4250	1	7DBU	14	1K5W012	125.3	225*	3.4*	225*	172.1*	N
	300	220	4300	2	5DBU	20	1K2W015	148.9	252*	3.0*	252*	190.5*	O

** These values are per individual DBU, as seen between DBU terminals B1 and B2.*

*** Wiring diagrams are shown in Chapter 3: Component Configuration and Wiring.*

**** 10% Duty Cycle with maximum ON (braking) time of 10 seconds.*

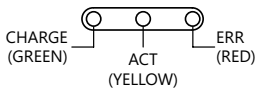
Dynamic Braking Unit Specifications

The following table provides the specifications and applications for the *DURAPULSE* dynamic braking units designed for use with GS3 and GS4 series AC drives.

Dynamic Braking Unit Specifications								
Braking Unit Part Number		**GS-1DBU**	**GS-2DBU**	**GS-3DBU**	**GS-4DBU**	**GS-5DBU**	**GS-6DBU**	**GS-7DBU**
Nominal Voltage (VAC)		230		460				
Max Motor Capacity (hp/[kW])		20 [15]	30 [22]	40 [30]	60 [45]	150 [110]	200 [160]	250 [185]
Output Rating	**Max Discharge Current (A) @ 10% Duty Cycle***	40	60	40	60	126	190	225
	Continuous Discharge Current (A)	15	20	15	18	45	50	100
	Braking Startup Voltage (VDC)	330/345/360/ 380/400/415 ±3V		660/690/720/ 760/800/830 ±6V		618/642/667/690/ 725/750 ±6V		
	Maximum On-Time (s)	10						
Input DC Voltage (VDC)		200–415		400–830		400–750		
Min Equivalent Resistor for Each Braking Unit (Ω)		10	6.8	20	13.6	6	4	3.4
Protection	**Power CHARGE Lamp/LED**	Comes ON until DC bus voltage (+P – -N) drops below 50VDC				Comes ON when DC bus voltage (DC+ – DC-) rises above 300VDC. Goes OFF when DC bus voltage (DC+ – DC-) drops below 100VDC.		
	Braking ACT Lamp/LED	ON during braking						
	Fault ERR Lamp	ON if an over-temperature fault has occurred				n/a		
	Overcurrent Level LED (A)	n/a				190	290	340
	Overheat LED	n/a				Comes ON > 176°F [80°C]; Goes OFF < 149°F [65°C]		
	Heat Sink Overheat Temperture	203°F [95°C]				n/a		
	Alarm Output Relay Contact	5A @ 120VAC/28VDC (RA,RB,RC)				3A @ 250VAC/28VDC (RA,RC)		
Environment	**Installation Location**	indoor (no corrosive gases; no metallic dust)						
	Operating Temperature	14°F to 122 °F [-10 to +50 °C]						
	Storage Temperature	-4 to +140 °F [-20 to +60 °C]						
	Humidity	less than 90% RH, non-condensing						
	Vibration	9.8 m/s^2 [1G] under 20Hz ; 2m/s^2 [0.2G] at 20–50 Hz						
Mechanical Configuration		IP50 wall-mount enclosed				IP10 wall-mount enclosed		
** 10% Duty Cycle with maximum ON (braking) time of 10 seconds*								

Lamp/LED Indicators for Dynamic Braking Units

GS-1DBU, GS-2DBU, GS-3DBU, GS-4DBU



GS-5DBU, GS-6DBU, GS-7DBU

See "DBU Jumper and Wiring Terminal Locations" in Chapter 3 for locations of indicators.

Dynamic Braking Resistors Specifications

Braking Resistor Specifications				
Part Number	Power (W)	Resistance (Ω)	Type	Dimension Drawing # (See chapter 2)
GS-20P5-BR	80	200	open	1
GS-21P0-BR	80	200		1
GS-22P0-BR	300	100		1
GS-23P0-BR	300	70		1
GS-25P0-BR	400	40		1
GS-27P5-BR	500	30		2
GS-2010-BR-ENC	1000	20	enclosed	4
GS-2015-BR-ENC	2400	13.6		5
GS-2020-BR-ENC	3000	10		5
GS-2025-BR-ENC	4800	8		6
GS-2030-BR-ENC	4800	6.8		6
GS-2040-BR-ENC	3000	10		5
GS-2050-BR-ENC	4800	8		6
GS-41P0-BR	80	750	open	1
GS-42P0-BR	300	400		1
GS-43P0-BR	300	250		1
GS-45P0-BR	400	150		1
GS-47P5-BR	500	100		2
GS-4010-BR	1000	75		3
GS-4015-BR-ENC	1000	50	enclosed	4
GS-4020-BR-ENC	1500	40		7
GS-4025-BR-ENC	4800	32		8
GS-4030-BR-ENC	4800	27.2		8
GS-4040-BR-ENC	6000	20		8
GS-4050-BR-ENC	9600	16		9
GS-4060-BR-ENC	9600	13.6		9
GS-4075-BR-ENC	6000	20		8
GS-4100-BR-ENC	9600	13.6		9
GS-BR-080W200	80	200	open	10
GS-BR-080W750	80	750		10
GS-BR-200W091	200	91		10
GS-BR-200W360	200	360		10
GS-BR-300W070	300	70		10
GS-BR-300W250	300	250		10
GS-BR-300W400	300	400		10
GS-BR-400W040	400	40		10
GS-BR-400W150	400	150		10
GS-BR-500W100	500	100		2
GS-BR-750W140	750	140		12

Braking Resistor Specifications (continued)				
Part Number	*Power (W)*	*Resistance (Ω)*	*Type*	*Dimension Drawing # (See chapter 2)*
GS-BR-1K0W4P3	1000	4.3	open	11
GS-BR-1K0W5P1	1000	5.1		11
GS-BR-1K0W016	1000	16		11
GS-BR-1K0W020	1000	20		11
GS-BR-1K0W075	1000	75		11
GS-BR-1K2W3P9	1200	3.9		11
GS-BR-1K2W015	1200	15		11
GS-BR-1K5W3P3	1500	3.3		11
GS-BR-1K5W012	1500	12		11
GS-BR-1K5W013	1500	13		11
GS-BR-1K5W043	1500	43		11

Braking Component Installation and Dimensions

Chapter 2

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Installation

General Installation Guidelines

Improper installation of the dynamic brake unit will greatly reduce its life. Be sure to observe the following precautions when selecting a mounting location.

Warning: Failure to observe these precautions may damage the unit and void the warranty!

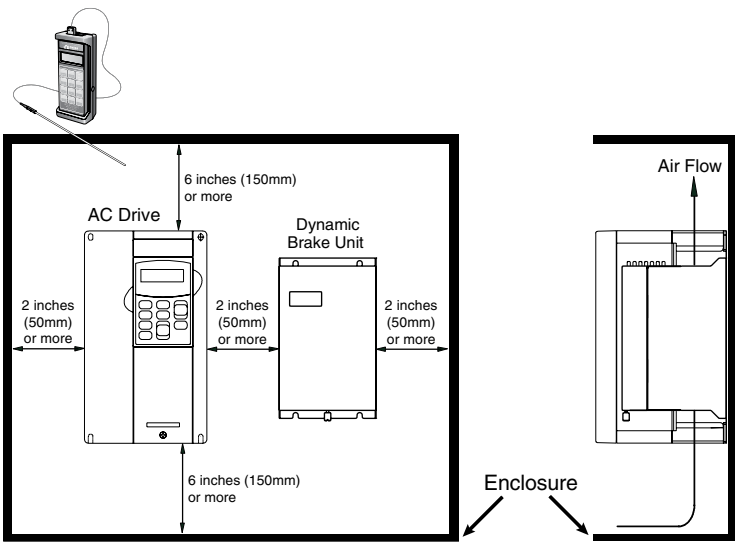
- Do not mount the dynamic brake unit near heat-radiating elements or in direct sunlight.
- Do not install the dynamic brake unit in a place subjected to high temperatures, high humidity, excessive vibration, corrosive gasses or liquids, or airborne dust or metallic particles.
- Mount the dynamic brake unit vertically and do not restrict the air flow to the heat sink fins.

Warning: The Dynamic Brake Unit and Braking Resistors generate large amounts of heat which may damage the braking unit, resistors, or any equipment mounted in the same enclosure as the heat producing devices. Auxiliary cooling methods are typically required so as not to exceed maximum ambient temperatures, especially if frequent deceleration braking is performed (over 10% duty cycle).

Warning: Flammable solids, gases, or liquids must be avoided at locations where braking resistors are installed. Ideally, Braking resistors should be installed in individual metallic boxes with forced air-cooling.

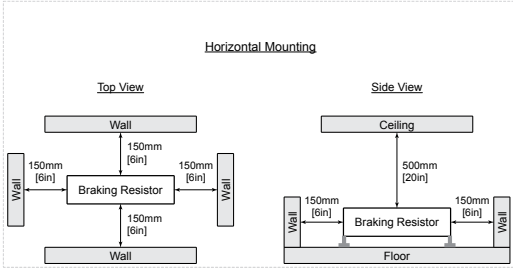
Minimum Clearances and Air Flow

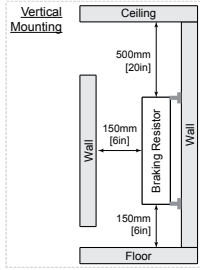
Minimum Clearances for Drives and Dynamic Braking Units



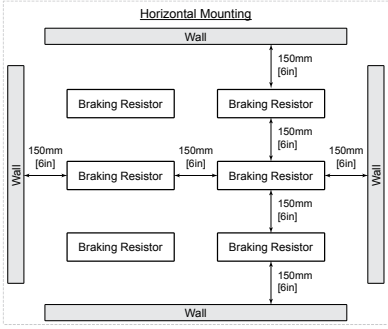
Minimum Clearances for Braking Resistors

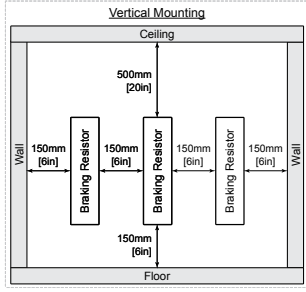
Mounting Individual Resistors





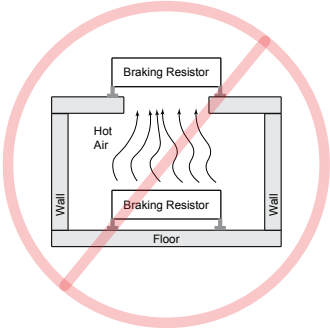
Mounting Multiple Resistors



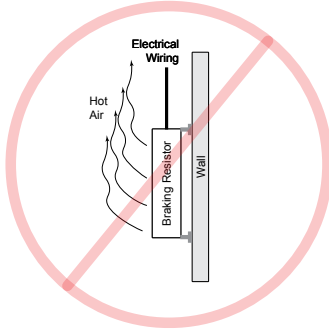


Do NOT Mount Heat-Producing or Heat-Sensitive Items Above Braking Resistors

Do NOT mount one resistor above another one!

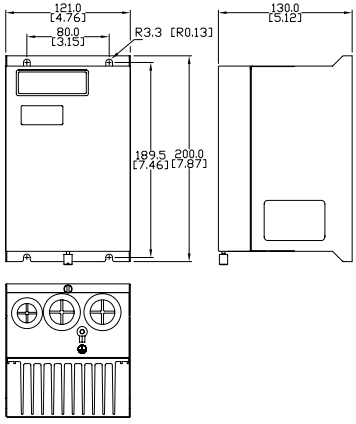


Do NOT run electrical wiring above a resistor!

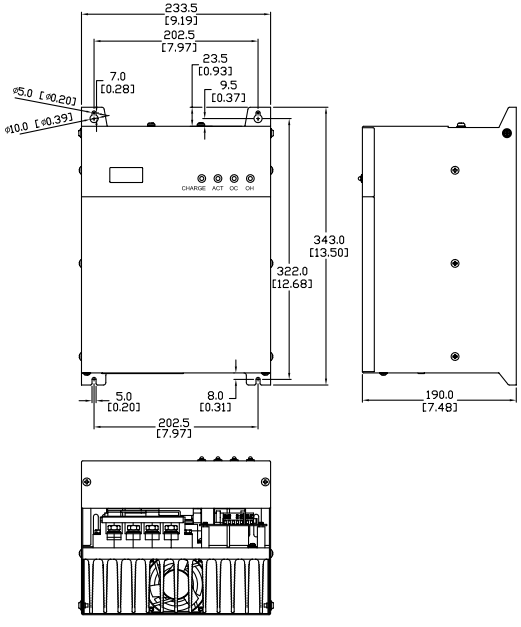


Braking Unit Dimensions

A) DBU ≤ 100hp (GS-1DBU, GS-2DBU, GS-3DBU, GS-4DBU)
(Dimensions = mm [in])



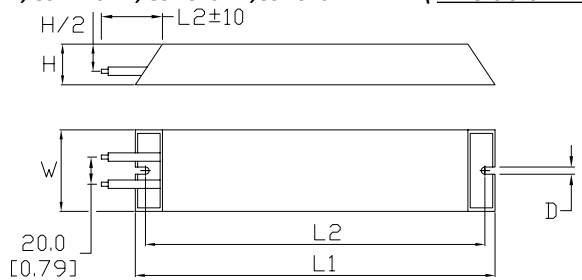
B) DBU > 100hp (GS-5DBU, GS-6DBU, GS-7DBU)
(Dimensions = mm [in])



Braking Resistor Dimensions

Braking Resister Dimension Drawing Index											
Resistor	**#**	**Resistor**	**#**	**Resistor**	**#**	**Resistor**	**#**	**Resistor**	**#**	**Resistor**	**#**
GS-20P5-BR	1	GS-41P0-BR	1	GS-BR-080W200	10	GS-BR-1K0W4P3	11	GS-2010-BR-ENC	4	GS-4015-BR-ENC	4
GS-21P0-BR	1	GS-42P0-BR	1	GS-BR-080W750	10	GS-BR-1K0W5P1	11	GS-2015-BR-ENC	5	GS-4020-BR-ENC	7
GS-22P0-BR	1	GS-43P0-BR	1	GS-BR-200W091	10	GS-BR-1K0W016	11	GS-2020-BR-ENC	5	GS-4025-BR-ENC	8
GS-23P0-BR	1	GS-45P0-BR	1	GS-BR-200W360	10	GS-BR-1K0W020	11	GS-2025-BR-ENC	6	GS-4030-BR-ENC	8
GS-25P0-BR	1	GS-47P5-BR	2	GS-BR-300W070	10	GS-BR-1K0W075	11	GS-2030-BR-ENC	6	GS-4040-BR-ENC	8
GS-27P5-BR	2	GS-4010-BR	3	GS-BR-300W250	10	GS-BR-1K2W3P9	11	GS-2040-BR-ENC	5	GS-4050-BR-ENC	9
				GS-BR-300W400	10	GS-BR-1K2W015	11	GS-2050-BR-ENC	6	GS-4060-BR-ENC	9
				GS-BR-400W040	10	GS-BR-1K5W3P3	11			GS-4075-BR-ENC	8
				GS-BR-400W150	10	GS-BR-1K5W012	11			GS-4100-BR-ENC	9
				GS-BR-500W100	2	GS-BR-1K5W013	11				
				GS-BR-750W140	12	GS-BR-1K5W043	11				

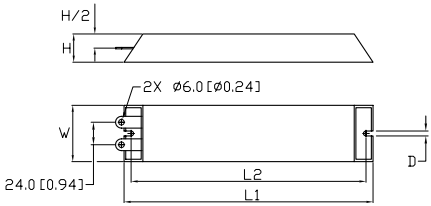
#1) GS-20P5-BR, GS-21P0-BR, GS-22P0-BR, GS-23P0-BR, GS-25P0-BR, GS-41P0-BR, GS-42P0-BR, GS-43P0-BR,GS-45P0-BR ***(Dimensions = mm [in])***



Resistor #	L1	L2	H	D	W
GS-20P5-BR	140 [5.51]	125 [4.92]	20 [0.79]	5.3 [0.21]	40 [1.57]
GS-21P0-BR					
GS-22P0-BR	215 [8.46]	200 [7.87]	30 [1.18]		60 [2.36]
GS-23P0-BR					
GS-25P0-BR	265 [10.43]	250 [9.84]			
GS-41P0-BR	140 [5.51]	125 [4.92]	20 [0.79]		40 [1.57]
GS-42P0-BR	215 [8.46]	200 [7.87]	30 [1.18]		60 [2.36]
GS-43P0-BR					
GS-45P0-BR	265 [10.43]	250 [9.84]			

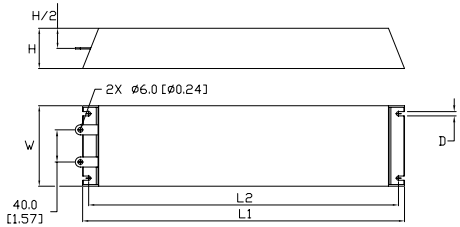
Braking Resistor Dimensions (continued)

#2) GS-27P5-BR, GS-47P5-BR (Dimensions = mm [in])



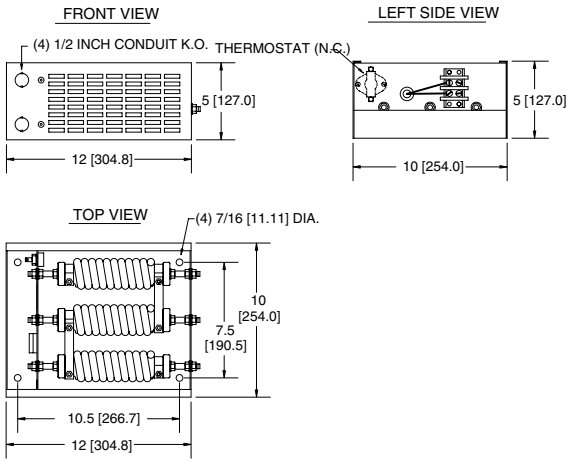
GS-27P5-BR GS-47P5-BR GS-BR-500W100	L1	L2	H	D	W
	335 [13.19]	320 [12.60]	30 [1.18]	5.3 [0.21]	60 [2.36]

#3) GS-4010-BR (Dimensions = mm [in])



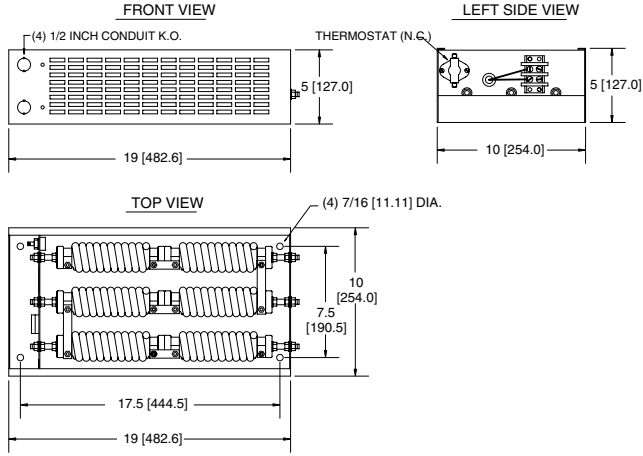
GS-4010-BR	L1	L2	H	D	W
	400 [15.75]	385 [15.16]	50 [1.97]	5.3 [0.21]	100 [3.94]

#4) GS-2010-BR-ENC, GS-4015-BR-ENC (Dimensions = in [mm])

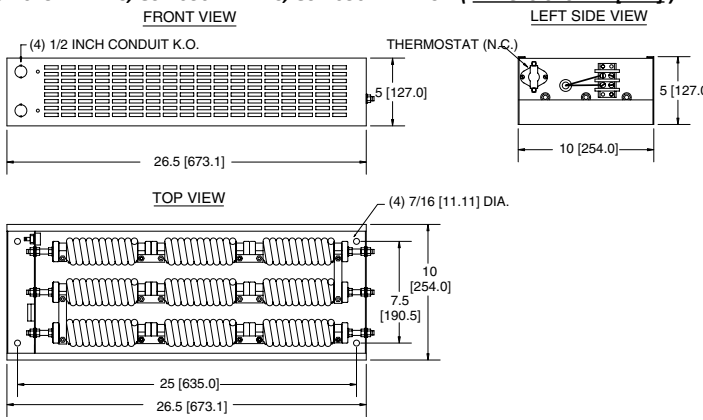


Braking Resistor Dimensions (continued)

#5) GS-2015-BR-ENC, GS-2020-BR-ENC, GS-2040-BR-ENC (Dimensions = in [mm])

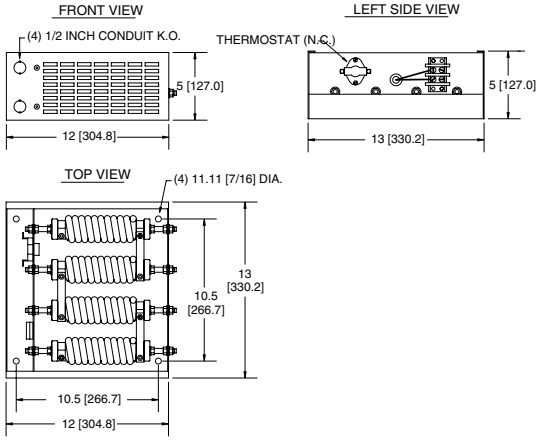


#6) GS-2025-BR-ENC, GS-2030-BR-ENC, GS-2050-BR-ENC (Dimensions = in [mm])

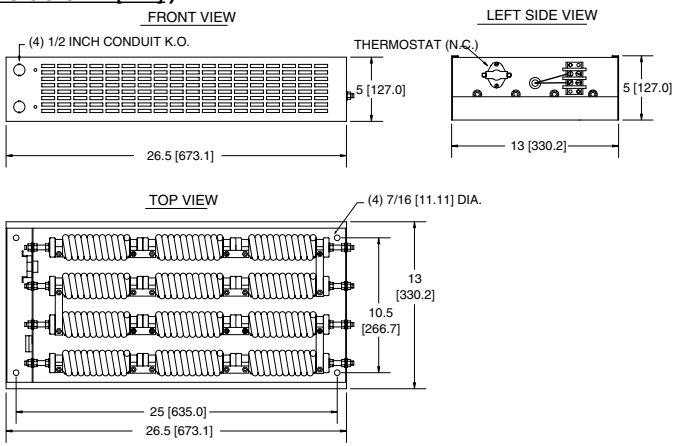


Braking Resistor Dimensions (continued)

#7) GS-4020-BR-ENC (Dimensions = in [mm])

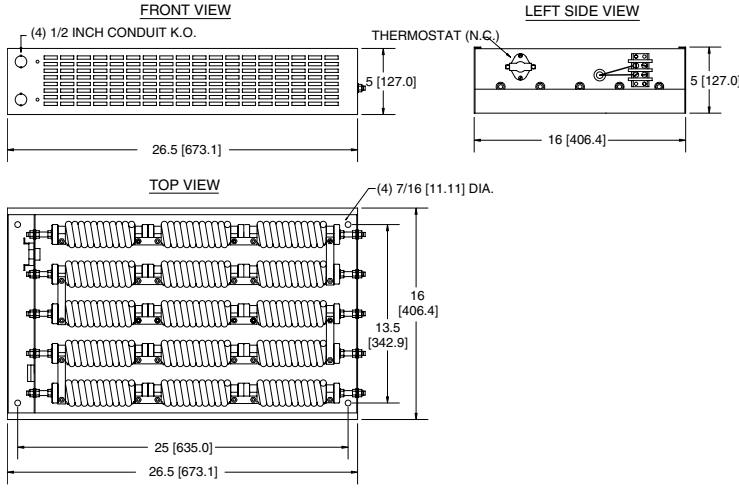


#8) GS-4025-BR-ENC, GS-4030-BR-ENC, GS-4040-BR-ENC, GS-4075-BR-ENC (Dimensions = in [mm])

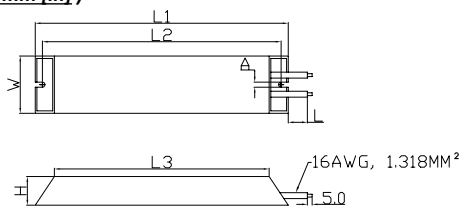


Braking Resistor Dimensions (continued)

#9) GS-4050-BR-ENC, GS-4060-BR-ENC, GS-4100-BR-ENC (Dimensions = in [mm])



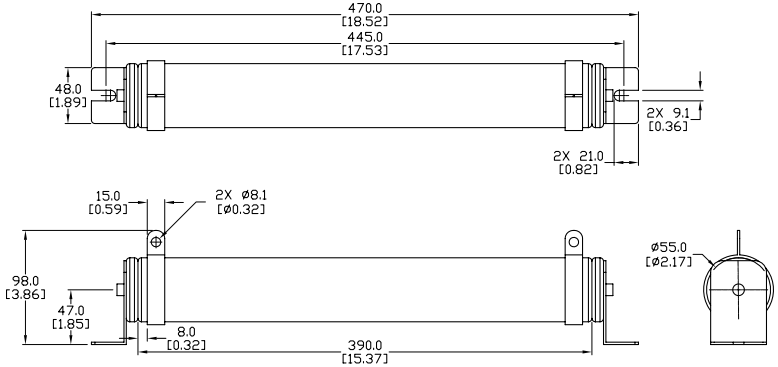
#10) GS-BR-080W200, GS-BR-080W750, GS-BR-200W091, GS-BR-200W360, GS-BR-300W070, GS-BR-300W250, GS-BR-400W040, GS-BR-400W150 (Dimensions = mm [in])



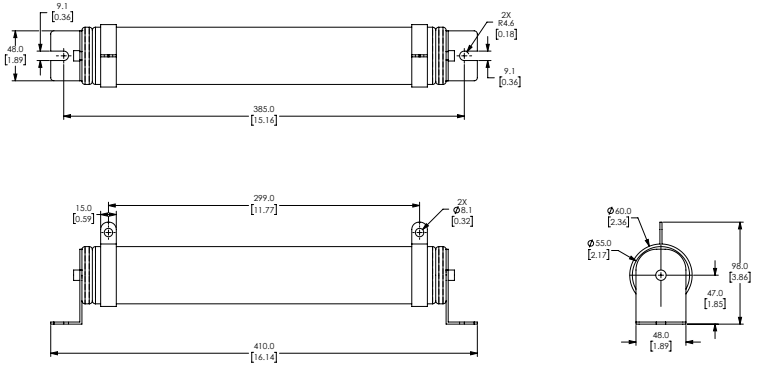
Resistor #	*L1*	*L2*	*L3*	*W*	*H*	*A*	*L*
GS-BR-080W200	140 [5.51]	125 [4.92]	100 [3.94]	40.0 [1.57]	20.0 [0.79]	5.3 [0.21]	200 [7.87]
GS-BR-080W750							
GS-BR-200W091	165 [6.50]	150 [5.91]	125 [4.92]	60.0 [2.36]	30.0 [1.18]		
GS-BR-200W360							
GS-BR-300W070	215 [8.46]	200 [7.87]	175 [6.89]				
GS-BR-300W250							
GS-BR-300W400							
GS-BR-400W040	265.34 [10.43]	250 [9.84]	225 [8.86]				
GS-BR-400W150							

Braking Resistor Dimensions (continued)

#11) GS-BR-1K0W4P3, GS-BR-1K0W5P1, GS-BR-1K0W016, GS-BR-1K0W020, GS-BR-1K0W075, GS-BR-1K2W3P9, GS-BR-1K2W015, GS-BR-1K5W3P3, GS-BR-1K5W012, GS-BR-1K5W013, GS-BR-1K5W043 (Dimensions = mm [in])



#12) GS-BR-750W140 (Dimensions = mm [in])



Braking Component Configuration and Wiring

Chapter 3

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Operational Electrical Information

The *DURAPULSE* AC Drive and Dynamic Braking Unit will both be energized at the same time when power is applied to the drive. (Please refer to the applicable *DURAPULSE* AC Drive User Manual (GS3_UMW or GS4_UMW) to determine the start and stop operation of the motor.) The Dynamic Braking Unit will monitor the internal DC bus voltage of the AC drive. When the AC drive stops the motor by decelerating, the braking unit will detect an increase in the drive's DC bus voltage due to the motor causing regeneration. The braking unit will then dissipate this excess energy into the braking resistor in the form of heat. Dissipating this regenerated energy will allow a stable and controlled deceleration of the motor.

The alarm relay output contact terminals (RC, RA, & RB) of the dynamic braking unit will be activated when the temperature of the braking unit heat sink exceeds 203°F (95°C) for DBUs ≤ 100hp, or 176°F (80°C) for DBUs > 100hp. This condition can be caused by the ambient temperature surrounding the braking unit exceeding 50°C (122°F), or by the Duty Cycle exceeding 10%. If this high ambient temperature situation exists, then a method of reducing the ambient temperature by the use of forced air cooling or some other means should be considered.

If the resistor does not have a temperature switch, install an overload relay between the DBU and the resistor.

Overload Relay

For safety purposes, install an external overload relay between the dynamic braking unit and the braking resistor. Wire the overload relay normally closed contact in series with the coil of a magnetic contactor to interrupt the power to the AC drive.

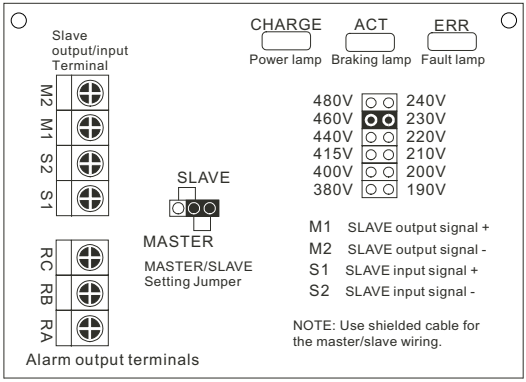
The purpose of installing the thermal overload relay is to protect the braking resistor from damage due to frequent braking, or due to the braking unit operating excessively due to unusually high input voltage.

For overload relay selection information, refer to "Overload Relay Selection" in Chapter 1, page 1-5.

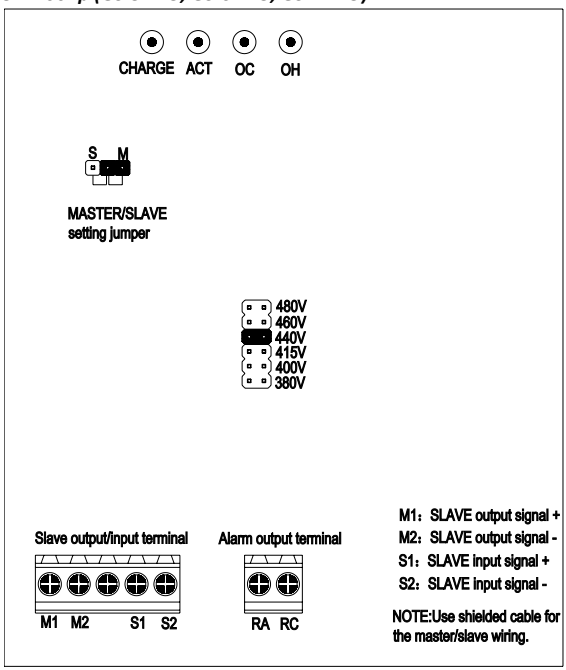
Dynamic Braking Unit Setup

DBU Jumper and Wiring Terminal Locations

DBU ≤ 100hp (GS-1DBU, GS-2DBU, GS-3DBU, GS-4DBU)



DBU > 100hp (GS-5DBU, GS-6DBU, GS-7DBU)



DBU Voltage Jumper Settings

The power source for the *DURApulse* dynamic braking unit is DC bus voltage from the +(P) and -(N) terminals of the GS drive. It is important to set the voltage selection jumper of the *DURApulse* dynamic braking unit accurately based on the input power of the GS drive before operation. The voltage selection jumper setting determines the GS DC bus voltage level at which dynamic braking is applied.

Before setting the voltage selection jumper, make sure the power has been turned off. Set the jumper to match the highest possible voltage for an unstable power system.
Example: A 380VAC power system rises to 410VAC on a regular basis. To avoid engaging dynamic braking when the power supply voltage rises above 380VAC, set the voltage selection jumper to the 415VAC position.

For DURApulse AC drives, set the "Over Voltage Stall Prevention" parameter as "close (1)" to disable over-voltage stall prevention (P6.05 in GS3; P6.11 in GS4). This will ensure a stable deceleration characteristic.

Braking Unit Voltage Settings

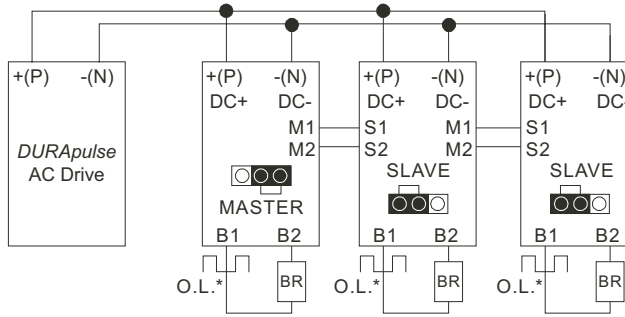
Models ≤ 100HP (GS-1DBU, GS-2DBU, GS-3DBU, GS-4DBU)				Models > 100HP (GS-5DBU, GS-6DBU, GS-7DBU)	
230VAC Class		460VAC Class		460VAC Class	
AC Power Voltage	Braking Start-up Voltage DC Bus (+(P), -(N)) Voltage	AC Power Voltage	Braking Start-up Voltage DC Bus (+(P), -(N)) Voltage	AC Power Voltage	Braking Start-up Voltage DC Bus (DC+,DC-) Voltage
190 VAC	330 VDC	380 VAC	660 VDC	380 VAC	618 VDC
200 VAC	345 VDC	400 VAC	690 VDC	400 VAC	642 VDC
210 VAC	360 VDC	415 VAC	720 VDC	415 VAC	667 VDC
220 VAC	380 VDC	440 VAC	760 VDC	440 VAC	690 VDC
230 VAC	400 VDC	460 VAC	800 VDC	460 VAC	725 VDC
240 VAC	415 VDC	480 VAC	830 VDC	480 VAC	750 VDC

NOTE: Input Power With Tolerance ±10%

DBU Master/Slave Jumper Settings

The MASTER/SLAVE jumper on the *DURApulse* dynamic braking unit has a factory default setting as a MASTER. If the application of the *DURApulse* AC drive requires the use of more than one DBU, then the power terminals of the multiple units are wired in parallel and the first unit is set to MASTER while all remaining units are set to SLAVE. The jumper settings along with the wiring between the MASTER/SLAVE (M1, M2, S1 & S2) terminals allows the multiple braking units to synchronize the power dissipation between braking units. This assures each unit is dissipating an equivalent amount of energy to allow rapid deceleration of the motor.

Typical one-line wiring diagram for multiple parallel DURApulse dynamic braking units. The first DBU has the jumper set to MASTER, while the remaining DBUs are set to SLAVE. (DBU ≤ 100hp have terminals +(P) & -(N); DBU > 100hp have terminals DC+ & DC-)



** Although it is recommended, the use of a thermal overload relay in line with the braking resistor is not required. GS-xxxx-BR-ENC braking resistors include a thermostat for thermal protection of the braking resistor, and are the preferred method of protection when available. Orient the braking resistors such that the thermostat is above the resistors in the enclosure, as this will ensure that the thermostat is exposed to the rising air temperature produced by the resistors. Refer to the "Basic Braking Wiring Diagram" on page 3–9 for details.*

Dynamic Braking Wiring

Wiring Warnings and Notes

Do not proceed with any wiring while power is applied to the circuit, or while the drive or DBU charge LED(s) are on.

To prevent personal injury, do not connect/disconnect wires or regulate the setting of the braking unit while power on. Do not touch the terminals of related wiring and any component on PCB lest users be injured by extremely dangerous DC high voltage.

Confirm that the +(P) and -(N) terminals of the DURApulse AC Drive are properly connected to the DURApulse dynamic braking unit with the correct polarity before applying power. Otherwise, the drive and the braking unit could be damaged.

Connect the braking unit ground terminal to Earth Ground. The ground lead must be the same gauge wire or larger than leads +(P) and -(N) or DC+ and DC-.

DO NOT wire terminals -(N) or DC- to the neutral point of the power system.

During braking, the wires connected to +(P), -(N), DC+, DC-, B1, and B2 generate powerful electromagnetic fields due to high current passing through. Separate these wires from other low voltage control circuits to prevent electrical interference or improper operation.

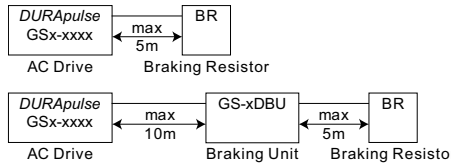
Before wiring the resistor(s) to the dynamic braking unit(s), check the min. resistor values shown in the Braking Component Selection tables in Ch.1 of this user manual, and make sure the actual resistance is no less than this value. Damage to the dynamic braking unit and/or resistors and other equipment can result if the wrong resistance value is used.

For safety purposes, install an overload relay between the dynamic braking unit and the braking resistor. Wire the overload relay normally closed contact in series with the coil of a magnetic contactor to interrupt the power to the AC drive to prevent damage to the braking resistor in the case of excessive braking or unusually high input voltage.

Maximum Wiring Distances

Wire sizes and wiring distances must comply with applicable electrical codes.

- From *DURApulse* AC Drive (GSx-xxxx) to Braking Resistor (GS-BR-xxxxxxx): 5m [16ft]
- From *DURApulse* AC Drive (GSx-xxxx) to *DURApulse* Dynamic Braking Unit (GS-xDBU): 10m [33ft]
- From *DURApulse* Dynamic Braking Unit (GS-xDBU) to Braking Resistor (GS-BR-xxxxxxx): 5m [16ft]



Dynamic Braking Unit Wiring Terminals

Wire sizes and wiring distances must comply with applicable electrical codes.

Ring terminals are recommended to be used for main circuit wiring. Make sure the terminals are fastened before power is applied.

Ring Terminals

Ring terminals are not required by UL, but they can be used according to the UL conditions of acceptability.

UL Conditions of Acceptability

For use only in Industrial Control Equipment where the acceptability is determined by Underwriters Laboratories Inc.

This component controller has been judged on the basis of the required spacings in the Standard for Power Conversion Equipment, UL 508C, Pollution Degree 2.

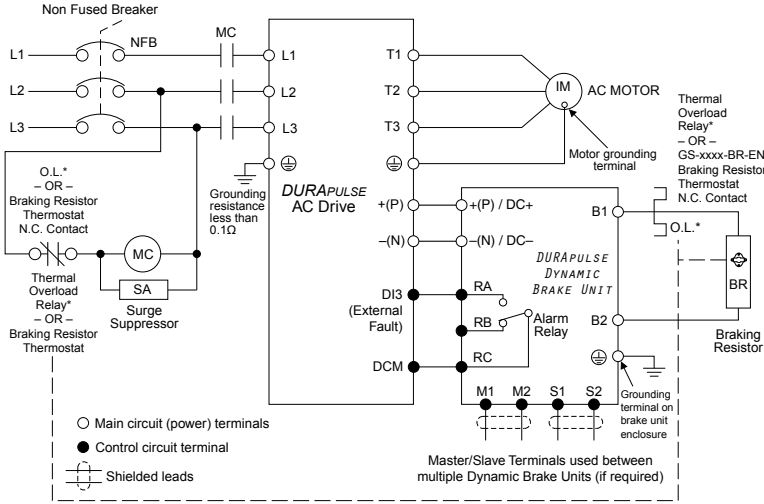
The following shall be considered in the final application:

1) Terminals are acceptable for factory or field wiring.
2) Device shall be installed in a suitable enclosure.
3) Failure mode testing of the voltage sensing circuit, which could result in operation of the DC bus input at transient voltages higher than 800VDC during motor regeneration, was not performed.
4) These devices should be mounted and used according to the manufacturer's directions and specifications with regard to compatibility with drive type (see Ratings Section) and braking resistor specification.
5) The manufacturer should provide in the end product all literature designating use of the devices as described in Condition of Acceptability 4) above.
6) Temperature testing was performed in a 150% outer enclosure and results found acceptable for use in 25°C ambient outside of the 150% outer enclosure. Use at elevated ambients with other enclosure configurations will require heat testing with the actual intended enclosure and the elevated ambient.

DBU Wiring Terminal Specifications

Braking Unit Wiring Terminal Specifications					
Braking Unit Models: GS-1DBU, GS-2DBU, GS-3DBU, GS-4DBU					
Circuit	**Terminal Mark**		**Wire Size**	**Screw**	**Torque**
Power Input Circuit	+(P), -(N)		10–12 AWG [3.5–5.5 mm^2]	M4	15.6 in·lb [18 kg·cm]
Braking Resistor	B1, B2		10–12 AWG [3.5–5.5 mm^2]	M4	15.6 in·lb [18 kg·cm]
Slave Circuit	Output	M1, M2	18–20 AWG [0.8–0.5 mm^2] (with shielded wires)	M2	3 in·lb [4 kg·cm]
	Input	S1, S2			
Fault Circuit	RA, RB, RC		18–20 AWG [0.8–0.5 mm^2]	M2	3 in·lb [4 kg·cm]
Braking Unit Models: GS-5DBU, GS-6DBU, GS-7DBU					
Circuit	**Terminal Mark**		**Wire Size**	**Screw**	**Torque**
Power Input Circuit	DC+, DC-		4–6 AWG [21.2–13.3 mm^2]	M8	26 in·lb [30 kg·cm]
Braking Resistor	B1, B2		4–6 AWG [21.2–13.3 mm^2]	M8	26 in·lb [30 kg·cm]
Slave Circuit	Output	M1, M2	18–20 AWG [0.8–0.5 mm^2] (with shielded wires)	M2	3 in·lb [4 kg·cm]
	Input	S1, S2			
Fault Circuit	RA, RC		18–20 AWG [0.8–0.5 mm^2]	M2	3 in·lb [4 kg·cm]

Basic Braking Wiring Diagram



* Although it is recommended, the use of a thermal overload relay in line with the braking resistor is not required. GS-xxxx-BR-ENC braking resistors include a thermostat for thermal protection of the braking resistor, and are the preferred method of protection when available. Orient the braking resistors such that the thermostat is above the resistors in the enclosure, as this will ensure that the thermostat is exposed to the rising air temperature produced by the resistors.

Smaller-capacity DURApulse AC Drives can connect directly to braking resistors, and do not require Dynamic Braking Units for braking. Refer to the "Dynamic Braking Component Selection" section of Chapter 1 to determine which braking components are required for each drive.

Although it is recommended, the use of a thermal overload relay in line with the braking resistor is not required. GS-xxxx-BR-ENC braking resistors include a thermostat for thermal protection of the braking resistor, and are the preferred method of protection when available. Orient the braking resistors such that the thermostat is above the resistors in the enclosure, as this will ensure that the thermostat is exposed to the rising air temperature produced by the resistors.

For overload relay information, Refer to the "Overload Relay" section at the beginning of this chapter.

Specific Braking Wiring Diagrams

Wiring Diagram Index for GS3 Drives

GS3 AC Drive Braking Wiring Diagram Index

230VAC Drive and Motor Voltage								460VAC Drive and Motor Voltage							
Motor Power		AC Drive Part #	Braking Unit		Braking Resistor		Wiring Diagram	Motor Power		AC Drive Part #	Braking Unit		Braking Resistor		Wiring Diagram
(HP)	(kW)	GS3-	Quantity	Part # GS-	Quantity	Part # GS-		(HP)	(kW)	GS3-	Quantity	Part # GS-	Quantity	Part # GS-	
1	0.7	21P0			1	21P0-BR		1	0.7	41P0			1	41P0-BR	
2	1.5	22P0			1	22P0-BR		2	1.5	42P0			1	42P0-BR	
3	2.2	23P0			1	23P0-BR		3	2.2	43P0			1	43P0-BR	
5	3.7	25P0	0	n/a	1	25P0-BR	A	5	3.7	45P0	0	n/a	1	45P0-BR	A
7.5	5.5	27P5			1	27P5-BR		7.5	5.5	47P5			1	47P5-BR	
10	7.5	2010			1	2010-BR-ENC		10	7.5	4010			1	4010-BR	
15	11	2015			1	2015-BR-ENC		15	11	4015			1	4015-BR-ENC	
20	15	2020	1	2DBU	1	2020-BR-ENC		20	15	4020	1	4DBU	1	4020-BR-ENC	
25	18	2025	1	2DBU	1	2025-BR-ENC	D	25	18	4025	1	4DBU	1	4025-BR-ENC	
30	22	2030	1	2DBU	1	2030-BR-ENC		30	22	4030	1	4DBU	1	4030-BR-ENC	D
40	30	2040	2	2DBU	2	2040-BR-ENC	F	40	30	4040	1	4DBU	1	4040-BR-ENC	
50	37	2050	2	2DBU	2	2050-BR-ENC		50	40	4050	1	4DBU	1	4050-BR-ENC	
								60	45	4060	1	4DBU	1	4060-BR-ENC	
								75	55	4075	2	4DBU	2	4075-BR-ENC	F
								100	75	4100	2	4DBU	2	4100-BR-ENC	

Wiring Diagram Index for GS4 Drives

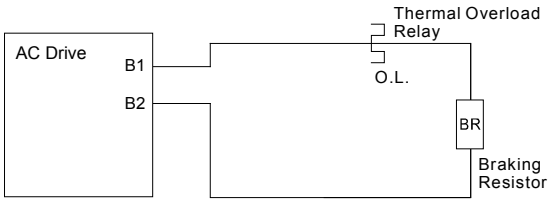
GS4 AC Drive Braking Wiring Diagram Index

230VAC Drive and Motor Voltage								460VAC Drive and Motor Voltage							
Motor Power		AC Drive Part #	Braking Unit		Braking Resistor		Diagram #	Motor Power		AC Drive Part #	Braking Unit		Braking Resistor		Diagram #
(HP)	(kW)	GS4-	Quantity	Part # GS-	Quantity	Part # GS-BR-		(HP)	(kW)	GS4-	Quantity	Part # GS-	Quantity	Part # GS-BR-	
1	0.7	21P0	0	n/a	1	080W200	A	1	0.7	41P0	0	n/a	1	080W750	A
2	1.5	22P0			1	200W091		2	1.5	42P0			1	200W360	
3	2.2	23P0			1	300W070		3	2.2	43P0			1	300W250	
5	3.7	25P0			1	400W040		5	3.7	45P0			1	400W150	
7.5	5.5	27P5			1	1K0W020		7.5	5.5	47P5			1	1K0W075	
10	7.5	2010			1	1K0W020		10	7.5	4010			1	1K0W075	
15	11	2015			1	1K5W013		15	11	4015			1	1K5W043	
20	15	2020			2	1K0W4P3	B	20	15	4020			2	1K0W016	B
25	18	2025			2	1K0W4P3		25	18	4025			2	1K0W016	
30	22	2030			2	1K5W3P3		30	22	4030			2	1K5W013	
40	30	2040	2	1DBU	4	1K0W5P1	G	40	30	4040			4	1K0W016	C
50	37	2050	2	2DBU	4	1K2W3P9		50	40	4050	1	4DBU	4	1K2W015	E
60	45	2060	2	2DBU	4	1K5W3P3		60	45	4060	1	4DBU	4	1K5W013	
75	55	2075	3	2DBU	6	1K2W3P9	J	75	55	4075	2	3DBU	8	1K0W5P1	H
100	75	2100	4	2DBU	8	1K2W3P9	K	100	75	4100	2	4DBU	8	1K2W015	I
								125	90	4125	2	4DBU	8	1K5W013	
								150	110	4150	1	5DBU	10	1K2W015	L
								175	132	4175	1	6DBU	12	1K5W012	M
								200	160	4200	1	6DBU	12	1K5W012	
								250	185	4250	1	7DBU	14	1K5W012	N
								300	220	4300	2	5DBU	20	1K2W015	O

Wiring Diagram A: [Drive + 1 Resistor]

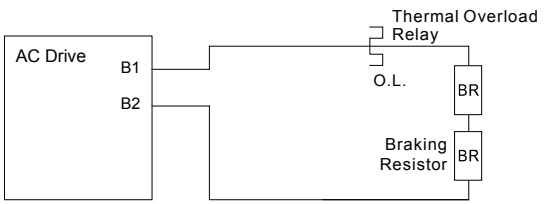
For GS3 230VAC Drives						For GS3 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.	AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS3-21P0	0	n/a	1	GS-21P0-BR	A	GS3-41P0	0	n/a	1	GS-41P0-BR	A
GS3-22P0			1	GS-22P0-BR		GS3-42P0			1	GS-42P0-BR	
GS3-23P0			1	GS-23P0-BR		GS3-43P0			1	GS-43P0-BR	
GS3-25P0			1	GS-25P0-BR		GS3-45P0			1	GS-45P0-BR	
GS3-27P5			1	GS-27P5-BR		GS3-47P5			1	GS-47P5-BR	
GS3-2010			1	GS-2010-BR-ENC		GS3-4010			1	GS-4010-BR	
GS3-2015			1	GS-2015-BR-ENC		GS3-4015			1	GS-4015-BR-ENC	

For GS4 230VAC Drives						For GS4 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.	AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS4-21P0	0	n/a	1	GS-BR-080W200	A	GS4-41P0	0	n/a	1	GS-BR-080W750	A
GS4-22P0			1	GS-BR-200W091		GS4-42P0			1	GS-BR-200W360	
GS4-23P0			1	GS-BR-300W070		GS4-43P0			1	GS-BR-300W250	
GS4-25P0			1	GS-BR-400W040		GS4-45P0			1	GS-BR-400W150	
GS4-27P5			1	GS-BR-1K0W020		GS4-47P5			1	GS-BR-1K0W075	
GS4-2010			1	GS-BR-1K0W020		GS4-4010			1	GS-BR-1K0W075	
GS4-2015			1	GS-BR-1K5W013		GS4-4015			1	GS-BR-1K5W043	



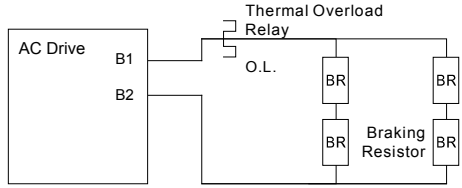
Wiring Diagram B: [Drive + 2 Series Resistors]

For GS4 230VAC Drives						For GS4 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.	AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS4-2020	0	n/a	2	GS-BR-1K0W4P3	B	GS4-4020	0	n/a	2	GS-BR-1K0W016	B
GS4-2025			2	GS-BR-1K0W4P3		GS4-4025			2	GS-BR-1K0W016	
GS4-2030			2	GS-BR-1K5W3P3		GS4-4030			2	GS-BR-1K5W013	



Wiring Diagram C: [Drive + (2 Series + 2 Parallel) Resistors]

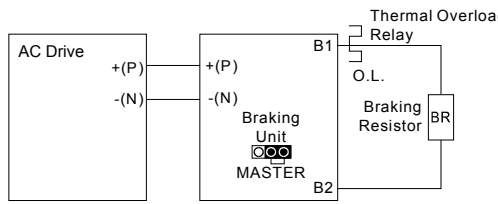
For GS4 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS4-4040	0	n/a	4	GS-BR-1K0W016	C



Wiring Diagram D: [Drive + 1 DBU + 1 Resistor]

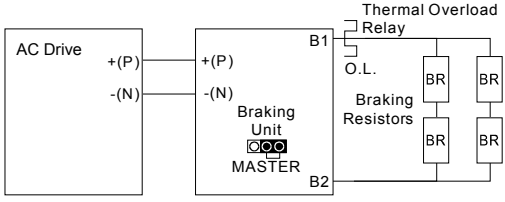
For GS3 230VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS3-2020	1	GS-2DBU	1	GS-2020-BR-ENC	D
GS3-2025	1	GS-2DBU	1	GS-2025-BR-ENC	
GS3-2030	1	GS-2DBU	1	GS-2030-BR-ENC	
n/a					

For GS3 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS3-4020	1	GS-4DBU	1	GS-4020-BR-ENC	D
GS3-4025	1	GS-4DBU	1	GS-4025-BR-ENC	
GS3-4030	1	GS-4DBU	1	GS-4030-BR-ENC	
GS3-4040	1	GS-4DBU	1	GS-4040-BR-ENC	
GS3-4050	1	GS-4DBU	1	GS-4050-BR-ENC	
GS3-4060	1	GS-4DBU	1	GS-4060-BR-ENC	



Wiring Diagram E: [Drive + 1 DBU + (2 Series + 2 Parallel) Resistors]

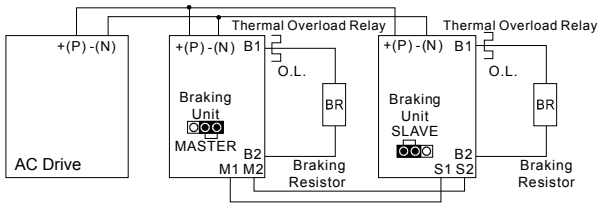
For GS4 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS4-4050	1	GS-4DBU	4	GS-BR-1K2W015	E
GS4-4060	1	GS-4DBU	4	GS-BR-1K5W013	



Wiring Diagram F: [Drive + 2 DBUs + 1 Resistor/DBU]

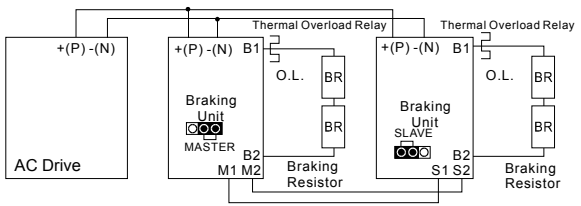
For GS3 230VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS3-2040	2	GS-2DBU	2	GS-2040-BR-ENC	F
GS3-2050	2	GS-2DBU	2	GS-2050-BR-ENC	

For GS3 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS3-4075	2	GS-4DBU	2	GS-4075-BR-ENC	F
GS3-4100	2	GS-4DBU	2	GS-4100-BR-ENC	



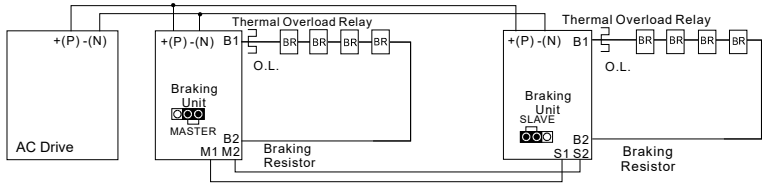
Wiring Diagram G: [Drive + 2 DBUs + 2 Series Resistors/DBU]

For GS4 230VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS4-2040	2	GS-1DBU	4	GS-BR-1K0W5P1	G
GS4-2050	2	GS-2DBU	4	GS-BR-1K2W3P9	
GS4-2060	2	GS-2DBU	4	GS-BR-1K5W3P3	



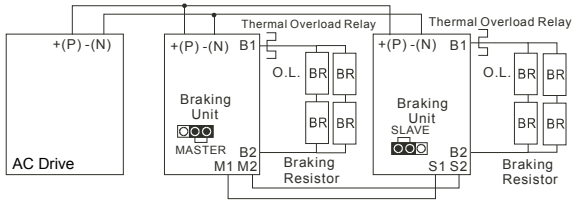
H: [Drive + 2 DBUs + 4 Parallel Resistors/DBU]

For GS4 460VAC Drives					
AC Drive Part #	Braking Unit		Braking Resistor		Diag.
	#	Part #	#	Part #	
GS4-4075	2	GS-3DBU	8	GS-BR-1K0W5P1	H



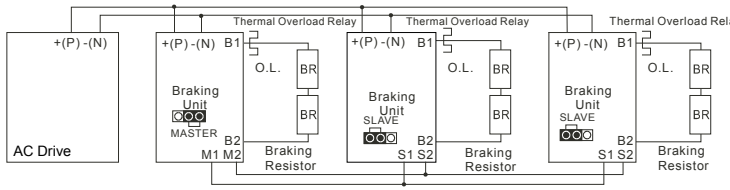
Wiring Diagram I: [Drive + 2 DBUs + (2 Series + 2 Parallel) Resistors/DBU]

For GS4 460VAC Drives					
AC Drive Part #	Braking Unit		Braking Resistor		Diag.
	#	Part #	#	Part #	
GS4-4100	2	GS-4DBU	8	GS-BR-1K2W015	I
GS4-4125	2	GS-4DBU	8	GS-BR-1K5W013	



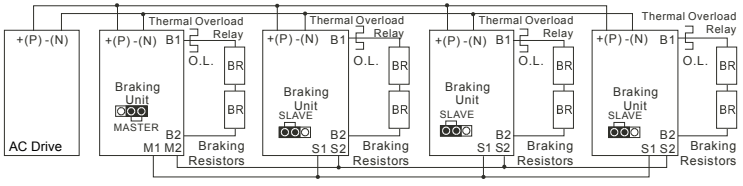
Wiring Diagram J: [Drive + 3 DBUs + 2 Series Resistors/DBU]

For GS4 230VAC Drives					
AC Drive Part #	Braking Unit		Braking Resistor		Diag.
	#	Part #	#	Part #	
GS4-2075	3	GS-2DBU	6	GS-BR-1K2W3P9	J



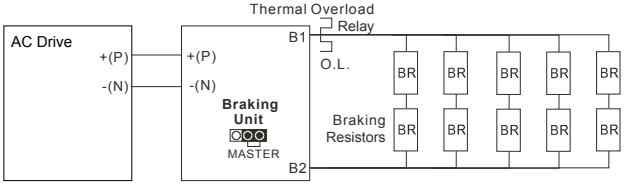
Wiring Diagram K: [Drive + 4 DBUs + 2 Series Resistors/DBU]

For GS4 230VAC Drives					
AC Drive Part #	Braking Unit		Braking Resistor		Diag.
	#	Part #	#	Part #	
GS4-2100	4	GS-2DBU	8	GS-BR-1K2W3P9	K



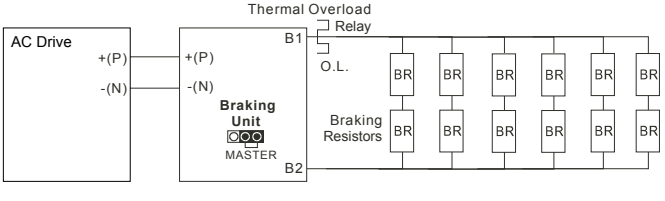
Wiring Diagram L: [Drive + 1 DBU + (2 Series + 5 Parallel) Resistors/DBU]

For GS4 460VAC Drives					
AC Drive Part #	Braking Unit		Braking Resistor		Diag.
	#	Part #	#	Part #	
GS4-4150	1	GS-5DBU	10	GS-BR-1K2W015	L



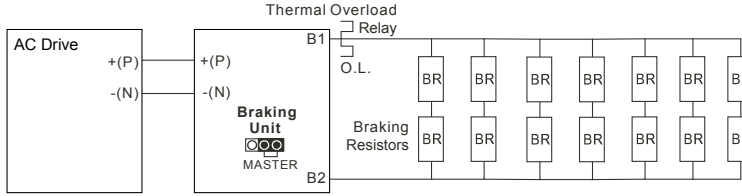
Wiring Diagram M: [Drive + 1 DBU + (2 Series + 6 Parallel) Resistors/DBU]

For GS4 460VAC Drives					
AC Drive Part #	Braking Unit		Braking Resistor		Diag.
	#	Part #	#	Part #	
GS4-4175	1	GS-6DBU	12	GS-BR-1K5W012	M
GS4-4200	1	GS-6DBU	12	GS-BR-1K5W012	



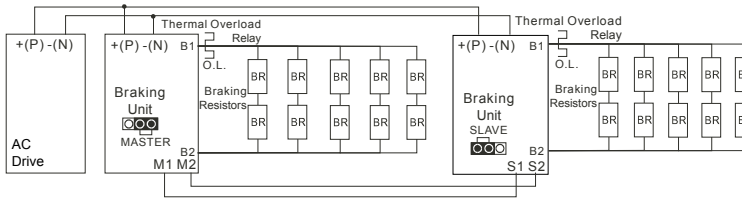
Wiring Diagram N: [Drive + 1 DBU + (2 Series + 7 Parallel) Resistors/DBU]

For GS4 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS4-4250	1	GS-7DBU	14	GS-BR-1K5W012	N



Wiring Diagram O: [Drive + 2 DBUs + (2 Series + 5 Parallel) Resistors/DBU]

For GS4 460VAC Drives					
AC Drive Part #	Braking Unit #	Braking Unit Part #	Braking Resistor #	Braking Resistor Part #	Diag.
GS4-4300	2	GS-5DBU	20	GS-BR-1K2W015	O



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